DETAILED ACTION

Citation to the Specification will be in the following format: (S. # : ¶/L) where # denotes the page number and ¶/L denotes the paragraph number or line number. Citation to patent literature will be in the form (Inventor # : LL) where # is the column number and LL is the line number. Citation to the pre-grant publication literature will be in the following format (Inventor # : ¶) where # denotes the page number and ¶ denotes the paragraph number.

Response to Arguments

Applicants' amendment to the Speicification has been recieved and will be entered. The objection to the disclosure is WITHDRAWN. New rejections appear forthwith, but in the interest of advancing prosecution, the Examiner makes the following remarks in response to Applicants arguments, followed by his own remarks:

Applicants present a discussion of each reference separately, before addressing the rejections. With respect to U.S. 5,114,477 to Mort, et al., Applicants present a general recitation of the teachings of Mort including the mixing step (Mort 8: 40-56) and addition of surfactants (Mort 7:55 - 8: 3). The mixing claimed (sonication) versus taught (generic mixing/shaking) was addressed in the Final Rejection of 1/7/2008. The addition of a surfactant as described by Mort has no relevance to patentability. If for no other reason, note that the claims do not exclude the addition of a surfactant. *See* MPEP 2111.03 Transitional Phrases (see definition of "comprising").

With respect to Satishkumar, Applicants present a brief recitation that generally mirrored the Final Rejection. With respect to Ausman, this reference was relied on in support of taking

official notice that sonication was old and known. *See* (Final Rejection of 1/7/2008 at 4) ("To the extent Mort may be silent on sonication as a mixing step, the Examiner takes official notice that sonication is a well known mixing/dispersing technique to those skilled in the art. In support of taking official notice, the Examiner cites to Auman, et al. *See e.g.* (Ausman at 8912, col. 1) ("dispersed by bath sonication").). Applicants have not traversed this finding or pointed out supposed errors in the Examiner's action as to why sonication would not be common knowledge or well-known. As such, sonication is taken to be common knowledge and well-known. *See* MPEP 2144.03 C.

Applicants then present a discussion of the current invention. (Remarks of 4/2/2008 at 8). This is noted, however it is the claims that define the invention. 35 U.S.C. 112, ¶2. Applicants then traverse the rejection, attacking the substitution of carbon nanotubes for the fullerenes of Mort. It is noted that in the traversal, Applicants do not address the motivation articulated in the Final Rejection of 1/7/2008. Applicants traverse on the basis of the differences between fullerenes and carbon nanotubes, citing to several pieces of non-patent literature. Applicants state that nanotubes have different properties, some being allegedly superior. A size difference was noted. Assuming *arguendo* that all of this is true, these facts do not address the rejection which was tailored to the *similarities* between fullerenes and carbon nanotubes. If anything, the recitiation of these additional properties, coupled with the known similarities between fullerenes and nanotubes buttresses the Examiner's case, providing more motivation to substitute nanotubes for fullerenes. If a sound, scientific case can be made as to why the properties of nanotubes would not work substituted in place of the fullerenes of Mort, this evidence could be persuasive.

The state of the art at the time of filing is of interest, not at the time of Mort; that Mort was not aware of nanotubes does not detract from the reference..

Applicants have made reference, presumably to column 9, line 62 of Mort which recites agitation of 72 hours in ethylene diamine, a surfactant. Presumably Applicants urge that it is only with this surfactant treatment that the fullerenes are soluble in the water. Assuming this is the case, as noted above it is immaterial to the pending claims, as the claims do not exclude the addition of a surfactant. The time of agitation recited is not viewed as particularly significant relative to that disclosed by Applicants, as a larger volume is being agitated in Mort. *Compare* (Mort 9: 60-62) (200 ml) *with* (S. 10: [00037]) (2 ml).

Before proceeding to the rejections, the Examiner makes the following remarks: Applicants themselves have made reference to Bandyopadhyaya, *Stabilization of Individual Carbon Nanotubes in Aqueous Solutions*, Nano Letters 2002; 2(1): 25-28. *See* (Remarks of 4/2/2008, ¶1). The Bandyopadhyaya article appears to contain the same disclosure and share the same inventorship. Bandyopadhyaya was published on the internet on 11/22/2001, and is not prior art when Applicants are accorded their foreign filing date of 3/26/2001. That said, it is worth noting a passage from Bandyopadhyaya, which states: "The dispersion method is based on an ancient Egyptian recipe, first used 5000 years ago for preparation of carbon-black ink:[19]" (Bandyopadhyaya at 25, col. 2). Footnote 19 references an Encyclopedia Brittanica article from 1966. The Examiner requested this article in the non-final rejection of 8/22/2007, and Applicants provided it in their response of 10/22/2007. The article makes mention to early inks made from grinding lampblack (i.e. carbon black) and a solution of glue or gums, and in turn dispersing this in aqueous solutions to make ink. (Encyclopedia Brittanica at 257, col. 1). Thus Applicants (and

the Egyptians) were clearly aware of ink making procedures which dispersed carbonaceous particles in an aqueous solution. It was ink making that lead to uncovering Mort, which - as noted in the Final Rejection of 1/7/2008 – is almost identical to Applicants claimed process – save the substitution of carbon nanotubes for fullerenes. Furthermore, as previously noted, Mort is (to this Examiner's knowledge) the first patent to issue employing carbon (fullerene) nanotechnology.

Patentability is judged at the time of invention. Thus, Applicants statement in the Bandyopadhyaya article has no legal relevance. Bandyopadhyaya, or rather the Encyclopedia Brittanica article, would seem to indicate that dispersions employing Gum Arabic have been known for some time. Mort recognizes this and takes it a step further and employs fullerenes as a substitute for or in addition to carbon black pigments. Applicants have focused on particular embodiments of Mort as evidence of "teaching away," etc. This is not necessarily persuasive. "The use of patents as references is not limited to what the patentees describe as their own inventions or to the problems with which they are concerned. They are part of the literature of the art, relevant for all they contain." *In re Heck*, 699 F.2d 1331, 1332-33, 216 USPQ 1038, 1039 (Fed. Cir. 1983) (quoting *In re Lemelson*, 397 F.2d 1006, 1009, 158 USPQ 275, 277 (CCPA 1968)). Thus, even if the Examiner has "selective amnesia" and totally forgets the statements from Bandyopadhyaya related to ink, etc., Mort can still form the basis of a proper rejection, as it discloses aqueous dispersions as claimed (sans nanotubes, of course). It is immaterial that Applicants did not set out to make ink. The only issue moving forward is whether a proper obviousness rejection can be supported with prior art available at the time of invention. Against this backdrop, the following rejections are made:

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action. The references cited teach each and every limitation of the rejected claims. The pinpoint citations are in no way to be construed as limitations of the teachings of the reference, but rather illustrative of particular instances where the teachings may be found.

Claims 1, 3-5, and 7-11 are rejected under 35 U.S.C. 103(a) as being unpatentable over US 5,114,477 to Mort, et al. in view of Satishkumar, et al., *Novel experiements with carbon nanotubes: opening, filling, closing and functionalizing nanotubes*, J. Phys. B: At. Mol. Opt. Phys. 1996; 29: 4925-4934 (hereinafter "Satishkumar at __"), Ausman, et al, *Organic Solvent Dispersions of Single-Walled Carbon Nanotubes: Pristine Nanotubes*, J. Phys. Chem. 2000; 104(38): 8911-8915, Qian, et al., *Load transfer and deformation mechanisms in carbon nanotube-polystyrene composites*, Applied Physics Letters 2000; 76(20): 2868-2870 (hereinafter "Qian at __"), Sinha, et al., *A novel approach to bulk synthesis of carbon nanotubes filled with metal by a catalytic chemical vapor deposition method*, Chemical Physics Letters 2000; 332: 455-460 (hereinafter "Sinha at __"), and Liu, et al., *Fullerene Pipes*, Science 1998; 280: 1253-1256.

With respect to Claims 1 and 7-8 Mort generally recites a method for preparing a suspension of fullerenes. *See e.g.* (Mort 6: 12, *et seq.*) (fullerenes). Note that aqueous solutions are recited. (Mort 5: 47-53) (describing aqueous liquid vehicles). Gum Arabic and polysaccharides (i.e. the "hydrophilic polymeric material") are recited in quantities of 0-10 % by

weight. (Mort 8: 4-19). Fullerenes are recited in concentrations of 1-20 % by weight. (Mort 6: 12-16). Thus, Mort teaches the mass ratio claimed. It is further noted that Mort *explicitly* recites the claimed hydrophobic/hydrophilic properties of the polymeric solution. (Mort 1: 11-16). As to the "sonication" step required by Claim 1, Mort describes a generic mixing step. *See* (Mort 8: 40 *et seq.*). To the extent Mort may be silent on sonication as a mixing step, the Examiner takes official notice that sonication is a well known mixing/dispersing technique to those skilled in the art. In support of taking official notice, the Examiner cites to Auman, et al. *See e.g.* (Ausman at 8912, col. 1) ("dispersed by bath sonication"). See also comments re: traversal of official notice in the Response to Arguments, *supra*. Optimizing the time now claimed is not inventive. Sonication time is a recognized result-effective variable. *See e.g.* (Qian at 2868, col. 2) ("We found that the optimum sonication times increased with the nanotube length.").

To the extent Mort describes "spherical fullerenes" versus carbon nanotubes, this does not impart patentability. Mort identifies the numerous advantages of utilizing fullerenes, including their solubilities in organic and aqueous solvents. *See* (Mort 4: 17-23). Further, the ability to tailor the properties of the fullerene through chemical modification was cited as advantageous. (Mort 4: 25-34). These same properties that make spherical fullerenes advantageous are well described in the literature for carbon nanotubes. *See* (Satishkumar – entire article; 4927 *et seq.* – filling; 4930 *et seq.* – functionalizing). Other, perhaps more explicit motivation can be found in Sinha. *See* (Sinha at 456, col. 1) (noting nanotubes as useful for magnetic ink). Any of these rationales are motivation to substitute nanotubes for fullerenes. Applicants have raised size as an issue; *see* (Remarks of 4/2/2008 at 10-11). Note that Mort discloses the ability to disperse pigments as large as 0.1 micron (= 100 nm). (Mort 7: 52). Thus,

it would appear as if Mort would be perfectly capable of dispersing nanotubes of the size lauded by Applicants as "of paramount scientific and technological importance in practical applications." (Remarks of 4/2/2008 at 10-11, citing to Liu, et al.). Note the Liu reference teaches fullerene tubes in the range of 10-300 nm. (Liu at 1253). Thus, while size has no relevance to the claims insofar as none was claimed, there is an expectation of success with at least this combination, and there is no reason to expect longer nanotubes would behave differently.

As to Claims 3-4, water removal via filtration is recited. (Mort 8: 45-51). As to Claim 5, Mort recites the water content of the dispersion being from about 60-99.5%. (Mort 6: 5-11). As such, the polymeric and nanotube concentration is less than 65% as required by Claim 5. With respect to Claims 9-11, the product is necessarily taught where the process has been identified. Any sort of adhesion interface phenomena is expected. Note that Mort appears to recite the phenomena Applicants have observed. *Compare* (S. "Fig 3") *with* (Mort 8: 4-8) ("Polymeric additives can also be added to the inks of the present invention to enhance the viscosity of the ink and the stability of the pigment particles and *to reduce the rate of agglomeration and precipitation of the particles*.") (emphasis added).

Conclusion

While several references were relied upon in the rejection, the combination (nanotubes in place of fullerenes) is, in this Examiner's opinion as buttressed by the facts of record, obvious to one skilled in the art. The Examiner is willing (and indeed bound by law) to consider any secondary indicia of non-obviousness. *See generally Graham v. John Deere Co.*, 383 U.S. 1

(1966). If Applicants have any to present, they should. Applicants expressed some confusion as to what "secondary indicia" are in the interview of 6/4/2008. Applicants are directed to MPEP 716 for a discussion of secondary indicia of non-obviousness, and how evidence should be presented.

All amendments made in response to this Office Action must be accompanied by a pinpoint citation to the Specification (i.e. page and paragraph or line number) to indicate where Applicants are drawing their support.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to DANIEL C. MCCRACKEN whose telephone number is (571)272-6537. The examiner can normally be reached on Monday through Friday, 9 AM - 6 PM EST.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Stanley S. Silverman can be reached on (571) 272-1358. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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